INEEL/EXT-02-01166
Revision 0

Conceptual Design Report for Removal, Treatment, and Disposal of Liquid from TSF-09 Tank V-3 for WAG 1, OU 1-10

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November 2002

Idaho National Engineering and Environmental Laboratory
Environmental Restoration Program
Idaho Falls, Idaho 83415

Prepared for the
U.S. Department of Energy
Assistant Secretary for Environmental Management
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ABSTRACT

This document constitutes the conceptual design for the decanting, filtering/treatment, containerization, and solidification/stabilization of approximately 6,000 gallons of liquid from Test Area North (TAN) tank V-3. The processing of the V-3 liquid in this manner and disposal of the solidified liquid at the INEEL CERCLA Disposal Facility (ICDF) is the baseline approach.

The overall objectives for this project are as follows:

- Removal of approximately 6,000 gal of liquid waste from TAN tank V-3
- Treat the liquid waste to meet ICDF Waste Acceptance Criteria (WAC)
- Containerize the treated liquid into 55-gal drums
- Solidify/stabilize the containerized liquid
- Transport the sealed containers to ICDF for disposal.

The design ideas presented in this Conceptual Design Report establish the general overall direction this project will take to accomplish the above-mentioned objectives. This document establishes a basis for project direction, initial cost estimating, and project scheduling. Design details will be presented in title design.

CONTENTS

FIGURES

ACRONYMS

EDF	Engineering Design File
GAC	granulated activated carbon
HEPA	high-efficiency particulate air (filter)
ICDF	INEEL CERCLA Disposal Facility
PCB	polychlorinated biphenyls
RI/FS	remedial investigation/feasibility study
TAN	Test Area North
WAC	Waste Acceptance Criteria
WAG	Waste Area Group

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1. INTRODUCTION

This conceptual design identifies the process and equipment necessary to decant, treat, solidify, and dispose of approximately 6,000 gal of aqueous liquid from Technical Support Facility (TSF)-09 Tank V-3. This scope is part of the OU 1-10 V-Tanks remedial action and is an early remedial action activity. The tank contains clear liquid above a layer of sludge. The sludge contains significantly more contaminants than the liquid including polychlorinated biphenyls (PCB). Every effort will be made to avoid disturbing the sludge during liquid removal. Liquid removal will reduce future material handling and treatment costs. The duration for remedial action activities will also be reduced by not having to process this liquid.

The 6,000 gal of decanted liquid will be disposed of at the INEEL CERCLA Disposal Facility (ICDF). This liquid will have to meet the ICDF Waste Acceptance Criteria (WAC) and, therefore, will need to be treated to ensure the WAC is met. The treatment process will consist of a train of filters.

The treated liquid will be placed in 55-gal drums, sampled to verify the ICDF WAC will be met, and then solidified/stabilized. The solidified drums will then be transported to the ICDF for final disposal.

1.1 Background

The remediation site addressed in this Conceptual Design Report (CDR) is situated in an open area east of Test Area North (TAN)-616 and north of TAN-607 (Figure 1). Waste from the TAN-616 evaporator pit sump and pump room sump, the TAN-607 Warm/Hot Shop drains, and Valve Pit #2 was transferred through the TAN-1704 valve pit (Valve Pit #1) to Tank V-9. The overflow from Tank V-9 drained to Tanks V-1, V-2, and V-3 (DOE-ID 2001). Tanks V-1, V-2, and V-3 are 10,000 gal underground storage tanks installed in 1953. They became operational in 1958. These V-tanks were designed to collect and store liquid radioactive waste at TAN. The waste stored in the V-tanks was treated in the evaporator system located in TAN-616. In 1972, the TAN-616 evaporator system failed and all wastes were directed to the PM-2A tanks (DOE-ID 1997). Tanks V-1 and V-3 became inactive in the early 1980s. Tank V-2 was taken out of service in 1968. In 1982 a portion of the free liquid was removed from the V-tanks. Additional wastewater was reportedly added to Tank V-3 through 1985. Starting in 1986, all low-level radioactive waste at TAN was rerouted to TAN-666 through a piping modification in the TAN-1704 valve pit. The piping modification stopped intentional input to the V-tanks in 1985.

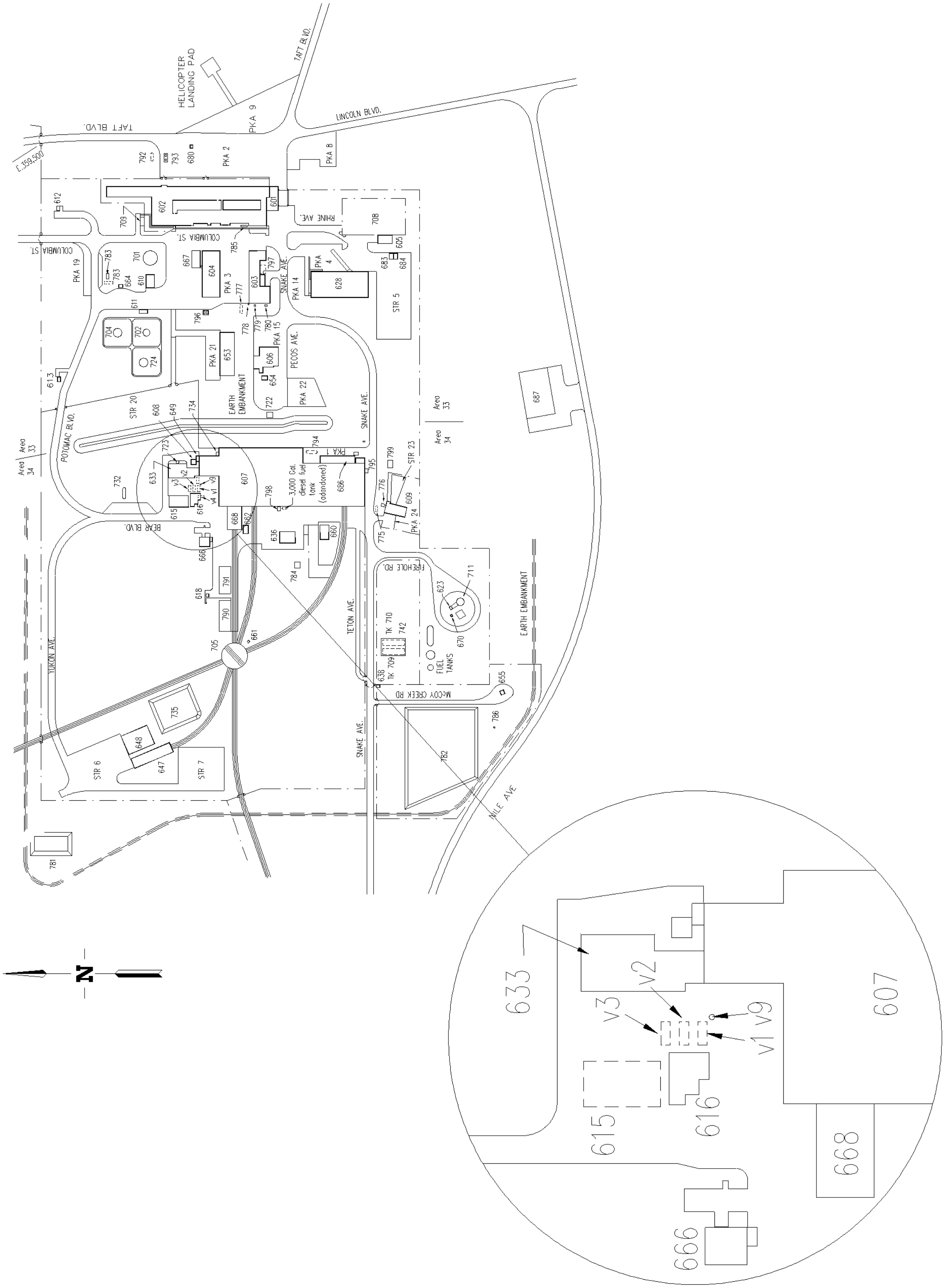


Figure 1. Test Area North area map.

Based on the 1993 Track 2 investigation and the 1996 remedial investigation/feasibility study (RI/FS) sampling results, the potential contaminants of concern for the three tanks were metals (e.g., mercury, chromium, and lead), volatile organic compounds (e.g., tetrachloroethene and trichloroethene), semivolatile organic compounds (e.g., PCBs), and radionuclides (e.g., Cs-137, Co-60, Sr-90, and various isotopes of plutonium and uranium) (DOE-ID 1997, INEL 1994). The 1996 RI/FS sample results indicated potentially problematic levels of fissile materials in the tanks. Evaluations of criticality issues associated with Tank V-3 determined that there is insufficient fissile mass for a criticality (Blackmore 1998, Nielson 2002).

2. TANK V-3 DESCRIPTION AND ASSUMPTIONS

Tank V-3 is a stainless steel tank 10 ft in diameter and 18 ft long. It is approximately 10 ft below ground surface. It has a 20-in. flanged manhole, accessible through a 6-ft-diameter culvert, installed in 1981 (DOE-ID 1997).

The volume of liquid and sludge in Tank V-3 was estimated based on the results of the 1996 RI/FS sampling (DOE-ID 1997). The volume of sludge was estimated at 652 gal. Estimated liquid volume was 5,818 gal (Blackmore 1998). From recent liquid level measurements, the current total volume in V-3 is 8,312 gal (EDF-3067). This volume represents 652 gal of sludge and 7,660 gal of liquid. The increase in volume has been attributed to in-leakage of rain/snow melt through the manhole. The manhole leakage was corrected in 1999.

This design is based on the assumption that the radiological levels allow hands-on operations, eliminating remote handling (EDF-2487). This Engineering Design File (EDF) shows that maximum exposure rates should be about 1.2 mR/h at contact with the liquid, which supports this assumption. It is also assumed, based on anticipated levels of airborne contaminants in and around the tank, that no ventilated containment will be required at the tank manhole during the decanting operation. It is anticipated that high-efficiency particulate air (HEPA) filters will be required to vent the drums as they are filled. Containment structures may be used to protect secondary containment pans from precipitation.

Bechtel BWXT Idaho (BBWI) Cost Estimating performed a cost estimate for this design and disposal option. Reference the letter from B. W. Wallace to G. E. McDannel and attachments for detailed cost estimate numbers (Wallace, 2002).

3. SYSTEM DESCRIPTION

3.1 Liquid Decant Subsystem

The liquid in Tank V-3 will be decanted using a Watson-Marlow SPX50 peristaltic hose-pump at a rate low enough to ensure the sludge does not get disturbed and entrained in the decanted liquid. This rate is expected to be 10 gpm or less. The pump flow rate will be adjusted appropriately using a variable frequency drive. The suction line will be lowered into the liquid to a level calculated to remove 6,000 gal and rigidly fastened to a support rod. The design concept is that this line will not have to be moved during the decanting process. A flow diverter at the end of the suction line will be used to divert the inlet flow of liquid away from the sludge layer. Figure 2 is a simplified schematic of the decanting, treatment, and containerization subsystems layout. A remote video camera will be used to visually verify that sludge is not entrained with the liquid being decanted. The pump can operate dry without damage if flow becomes restricted. The liquid will be pumped through the treatment subsystem into 55-gal drums. Access to the liquid will be through the 20 in. manhole and 6 ft diameter culvert providing access to the manhole from ground level. The culvert and tank will be a permit required confined space. A containment tent over the culvert and manhole shall be used to reduce possible contamination spread.

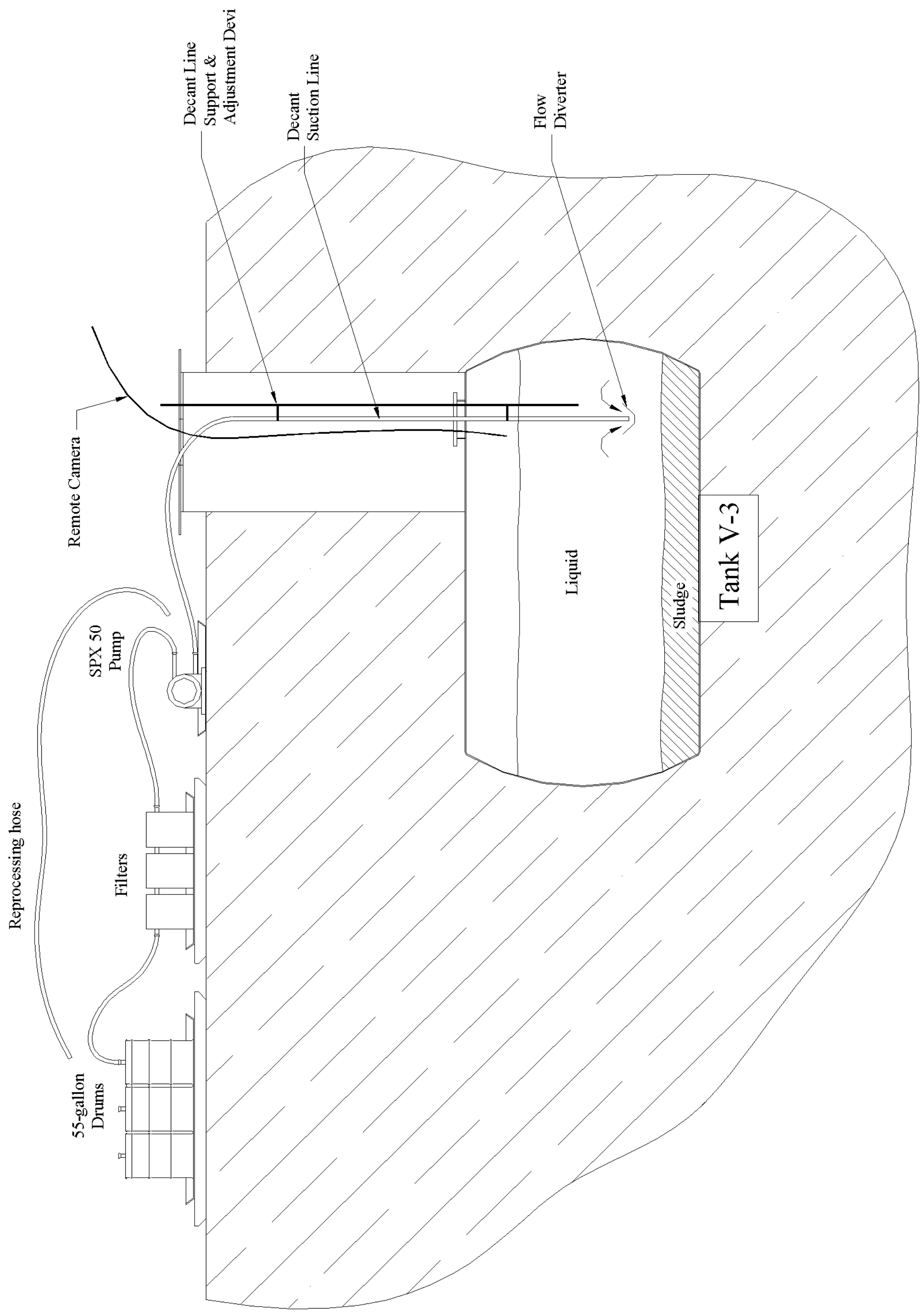


Figure 2. Simplified Schematic of V-3 Decant System.

The suction hose shall be a 2 in. Spiralite-115 (or equivalent). The Spiralite-115 will prevent the hose from collapsing during pumping operations. Discharge hose shall be 2 in. Buna N (or equivalent) between the pump and the first filter in the Treatment Subsystem and from the Treatment Subsystem to the 55-gal drum.

All hoses and fittings shall be poly sleeved (i.e., Bartlett Services, Inc. Super Sleever) to meet the requirement for double containment.

The Watson-Marlow SPX50 High-Pressure Hose Pump has a suction head capability of 28 ft (at ambient atmospheric pressure at TAN assuming the liquid temperature is about 50°F), which is more than adequate for the required 18 ft to 19 ft needed to place the pump at ground level. This is a positive displacement pump so the discharge pressure will only be what the system requires up to 232 psi. A pressure relief valve shall be located on the outlet side of the pump in case the pressure builds beyond acceptable limits. The pressure release shall empty back into Tank V-3. Because of the design of a peristaltic hose pump, no draining of the hose contents back into the tank will occur. Watson-Marlow guarantees the pinching of the hose in the pump will function as well or better than a check valve. The pump shall be mounted on a skid with drip pan for secondary containment. Power required for operation is 115/230 V single phase or 230/460 or 575 V three phase.

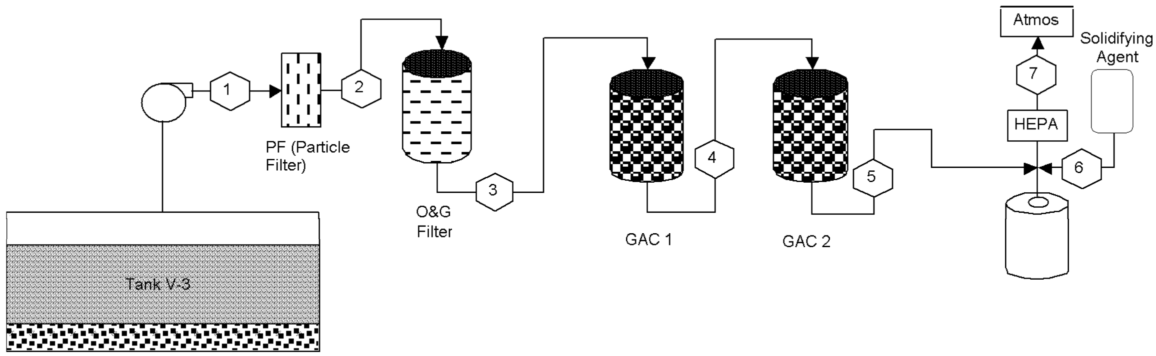
3.2 Treatment Subsystem

The decanted liquid must be treated to meet the ICDF WAC for disposal. The following filters are required in the treatment train based on EDF-6732 "Design of Tank V-3 Granular Activated Carbon (GAC) System." The mass balance table in EDF-6732 (also see Figure 3) gives values of contaminants based on a run-time (reference right hand table in Figure 3) of 600 minutes (i.e., 10 gpm for 6,000 gal). The values used are very conservative and determine loading on each of the treatment subsystem units.

- Particulate filter (PF) – 1 μm nominal simple cartridge filter.
- Oil and Grease (O&G) filter – 1 prepackaged unit consisting of a 55 gal drum containing 15 lbs of BoniFiber (or equivalent) rated for 10 gpm.
- Granulated activated carbon (GAC) filters – 2 Calgon Flowsorb® 55-gal canisters, or equivalent in series (two are specified due to uncertainty in determining capacity and breakthrough for more volatile species).

The treatment filter train is expected to handle the approximately 6,000 gal of liquid in tank V-3 without replacement of any filters due to loading or breakthrough. A second filter train, in parallel with the first would provide redundancy if problems are encountered with individual filter units. This is probably not justified for a temporary installation, such as this, that is expected to have a very brief run time (a few days at most) but will be left in until further analysis indicates it is not needed. Spare filter units of each type are required to be on-hand, however, should replacement become necessary. Pressure gauges shall be located on inlet and outlet of treatment subsystem and between each unit to monitor operation.

The treatment subsystem shall be mounted on a skid to enable proper placement and handling. A drip pan, or set of drip pans, shall be used for secondary containment. The leakage, if any, shall be monitored by the operators who will shut down the system to fix the leak, if feasible, and clean up the leakage. The units in this subsystem will be connected with short jumper hoses and quick disconnect fittings such as CAM-LOC fittings where feasible. A Stainless Steel CAM-LOC coupling will be used to connect the hose to the fill drum. The CAM-LOC couplings will assist in connecting and removing the hose from the drum fill-lid. The subsystem may need to be covered to prevent precipitation from getting into the drip pans and creating more waste.



	Feed	PF	O&G	GAC 1	GAC 2	Aquaset	HEPA					
Parameters	1	2	3	4	5	6	7					
Flow, gpm	10.00	10.00	10.00	10.00	10.00	N/A	10.00					
Flow, lb/min	83.30	83.30	83.30	83.30	83.30	N/A						
PH	7.40	7.40	7.40	7.40	7.40	N/A			Run Time, minutes			600
TOC, mg/L	58.50	58.50	58.50	1.17	0.02	N/A			Loaded Inventories			
TSS, mg/L	2.00	0.04	0.04	0.04	0.04	N/A		PF	O&G	GAC 1	GAC 2	Drums
Oil&Grease, mg/L	1.00	1.00	0.02	4.00E-04	8.00E-06	N/A		370 gm	15 lb	165 lb	165 lb	55 gal
Cations	**mg/L**									mg/g		
Ca+2	50.20	50.20	50.20	50.20	50.20	N/A			0	2.43E-02	2.43E-02	4.78
K+1	49.70	49.70	49.70	49.70	49.70	N/A			0	2.40E-02	2.40E-02	4.73
Mg+2	16.10	16.10	16.10	16.10	16.10	N/A			0	7.79E-03	7.79E-03	1.53
Mn+2	0.76	0.76	0.76	0.76	0.76	N/A			0	3.65E-04	3.65E-04	0.07
Na+1	164.50	164.50	164.50	164.50	164.50	N/A			0	7.96E-02	7.96E-02	15.66
Ni+2	0.18	0.18	0.18	0.18	0.18	N/A			0	8.90E-05	8.90E-05	0.02
Pb+2	0.05	0.05	0.05	0.05	0.05	N/A			0	2.44E-05	2.44E-05	0.00
Zn+2	0.84	0.84	0.84	0.84	0.84	N/A			0	4.08E-04	4.08E-04	0.08
Anions	**mg/L**									mg/g		
Cl-	76.20	76.20	76.20	76.20	76.20	N/A			0	3.68E-02	3.68E-02	7.26
HCO3-	443.79	443.79	443.79	443.79	443.79	N/A			0	1.91E-01	1.91E-01	42.26
PO4-3	1.28	1.28	1.28	1.28	1.28	N/A			0	5.51E-04	5.51E-04	0.12
SO4-2	0.76	0.76	0.76	0.76	0.76	N/A			0	3.25E-04	3.25E-04	0.07
Inerts	**mg/L**									mg/g		
SiO2	14.94	14.94	14.94	14.94	14.94	N/A			0	7.22E-03	7.22E-03	1.42
CO2.H2O	49.31	49.31	49.31	49.31	49.31	N/A			0	2.12E-02	2.12E-02	4.70
Organics	**mg/L**									mg/g		
bis(2-ethylet)pht	0.10	0.10	0.10	2.00E-03	4.00E-05	N/A			0	1.69E-02	3.38E-04	3.81E-06
1,1-dichloroethane	0.02	0.02	0.02	3.80E-04	7.60E-06	N/A			0	3.21E-03	6.42E-05	7.24E-07
1,2-dichloroethylene	0.20	0.20	0.20	4.00E-03	8.00E-05	N/A			0	3.38E-02	6.76E-04	7.62E-06
pyrene	0.06	0.06	0.06	1.26E-03	2.52E-05	N/A			0	1.06E-02	2.13E-04	2.40E-06
TCE	0.20	0.20	0.20	4.00E-03	8.00E-05	N/A			0	3.38E-02	6.76E-04	7.62E-06
Vinyl chloride	0.01	0.01	0.01	2.20E-04	4.40E-06	N/A			0	1.86E-03	3.72E-05	4.19E-07
Radionuclides	**nCi/L**						Sludge, nCi/g			nCi/g		
H-3	6090.00	6090.00	6029.70	5742.57	5469.12	N/A			2.01E+02	5.23E+01	4.98E+01	5.21E+02
Co-60	9.64	9.64	9.54	9.09	8.66	N/A	187.3	22.53	3.18E-01	8.28E-02	7.88E-02	8.24E-01
Ni-63	205.00	205.00	202.97	193.31	184.10	N/A	954.2	114.79	6.76E+00	1.76E+00	1.68E+00	1.75E+01
Sr-90	12300.00	12300.00	12178.22	11598.30	11046.00	N/A	21622	2601.16	4.06E+02	1.06E+02	1.01E+02	1.05E+03
Cs-134	0.22	0.22	0.22	0.21	0.20	N/A	1.3994	0.17	7.40E-03	1.93E-03	1.84E-03	1.92E-02
Cs-137	2895.00	2895.00	2866.34	2729.84	2599.85	N/A	7598	914.05	9.55E+01	2.49E+01	2.37E+01	2.48E+02
U-233/234	13.30	13.30	13.17	12.54	11.94	N/A	2.232	0.27	4.39E-01	1.14E-01	1.09E-01	1.14E+00
U-235	0.40	0.40	0.40	0.38	0.36	N/A	0.0728	0.01	1.32E-02	3.43E-03	3.27E-03	3.42E-02
U-238	0.14	0.14	0.13	0.13	0.12	N/A	0.0682	0.01	4.45E-03	1.16E-03	1.10E-03	1.15E-02
Pu-238	0.04	0.04	0.04	0.04	0.03	N/A	13.34	1.60	1.25E-03	3.26E-04	3.11E-04	3.25E-03
Pu-239/240	0.02	0.02	0.02	0.02	0.02	N/A	6.892	0.83	6.50E-04	1.69E-04	1.61E-04	1.68E-03
Am-241	0.03	0.03	0.03	0.03	0.03	N/A	7.16	0.86	1.05E-03	2.73E-04	2.60E-04	2.72E-03

Figure 3. Material balances and flow.

3.3 Containerization

The liquid exiting the treatment subsystem will be transferred into 55-gal polyethylene drums, at approximately 45 gal per drum, to allow for volume expansion during solidification/stabilization. Utilizing the 55-gal drums, that will ultimately be used to transport the solidified waste to ICDF, as the interim storage containers for the liquid avoids additional secondary waste (i.e., high-integrity container or other temporary tankage). The poly drums will be open-head drums with ring clamps fastening the drum lid to the drum. There will be no openings in the drum lid. A fill-lid will be constructed with attachments for the pump hose and HEPA filter. The HEPA will be necessary to capture airborne contaminants that may be present in the drum when filling. These will be small units that will attach directly to the drum fill-lid. This fill-lid will be moved from drum to drum during the filling process. The filling of the drum will be controlled by the operator utilizing a flow-meter/totalizer unit to measure the amount of liquid entering the drum. When the drum contains the proper amount of liquid, the pump will be stopped until the next drum is ready for filling. The hose pump features will not allow drainage back into the tank when the pump is stopped. The liquid-filled drums will be stored temporarily at a TAN location identified by Waste Generator Services (WGS) while awaiting sample results. The temporary storage location shall be adjacent to the drum fill area if feasible. If the drums must be moved out of the processing area, they shall be surveyed to ensure there is no external radiological contamination on the drums. If radiological contamination is found, these drums will be decontaminated to meet Radiological Control's requirements. The use of 55-gal poly drums is preferred for the following reasons:

- relative ease of handling
- acceptability at ICDF
- Department of Transportation (DOT) acceptability for transportation.

If the ICDF WAC is not met, the filter units shall be inspected to ensure they are still operable and then the liquid will be reprocessed through the treatment train until the necessary requirements are met. If the sample results indicate the treatment subsystem cannot meet the ICDF WAC, as configured, the modular design allows a unit or units to be replaced as appropriate; e.g., a like for like replacement if a unit was malfunctioning or loaded to capacity, or an entirely different unit such as ion exchange. Drums containing noncompliant liquid will need to be moved from temporary storage back out to the drum fill skid. A new suction line will be connected from the drum fill-lid, with an extension added to reach the bottom of the drum, to the pump for removal of the non-compliant liquid for reprocessing. The re-treated liquid shall be pumped into a clean spare drum or back into an emptied drum where new samples shall be taken for analysis. It is assumed that the emptied drums will not require rinsing prior to filling with re-treated liquid. The newly-filled drums shall then be moved into temporary storage to await sampling results.

3.4 Sampling

Samples shall be taken from selected drums of liquid waste as specified by WGS and in accordance with an approved Field Sampling Plan. It is assumed that manual grab samples are adequate and, therefore, no special sampling apparatus is required. The sample results will be used to ensure that the treated liquid will be in compliance with the ICDF WAC once it has been solidified/stabilized. After compliance is verified, the contents of the poly drums can be solidified/stabilized.

3.5 Solidification/Stabilization

When the sample results indicate that the WAC can be met once the liquid is solidified/stabilized, the drum lids will be removed and a solidification/stabilization agent such as Fluid Tech, Inc.'s Aquaset or equivalent will be manually added to solidify the drum contents. Approximately 100 lbs of Aquaset will be added to each drum. The Aquaset will be scooped into each drum with no mixing required. Appropriate personal protective equipment (PPE) shall be worn per radiological and airborne contaminant requirements. After letting the agent set for approximately 24 hours, the solidification of all free liquid will be visually verified then the drum will be sealed by placing the lid on the drum and using a ring clamp to ensure closure. If any free liquid is observed after the set time, additional solidification agent will be added, allowed to set, and then the visual verification to ensure no free liquid is present will be repeated. This will be done at the temporary storage area so the drums do not need to be moved. This will take advantage of the secondary containment in place. If radiological contamination is found after closure, these drums will be decontaminated to meet Radiological Control's requirements.

3.6 Storage/Transportation

The solidified/stabilized 55-gal drums will remain at the temporary storage area until they are transported to the ICDF for disposal. Because the liquid is solidified, transportation issues are significantly simplified. In 49 *Code of Federal Regulations* (CFR) 173.410, this solidified material is categorized as Low Specific Activity, LSA-II, material. Minimum packaging requirements for LSA material is "strong, tight" which includes the 55-gal poly drums discussed above. All 49 CFR 173.410 general design requirements will be followed.

The treatment subsystem filters will be tested for compliance with land disposal restriction (LDR) levels and disposed of accordingly. The GAC units are not expected to meet ICDF's WAC (reference EDF-6732) for disposal and will be packaged for shipment offsite to an approved waste disposal facility.

4. PROCESS PROCEDURE

Figures 4 and 5 show the V-Tank water removal Process and Instrumentation Diagram (P&ID), and the process flow. The current plan is to proceed following the procedures outlined in Management Control Procedure (MCP)-3562, "Hazard Identification, Analysis and Control of Operational Activities," but further investigation of the applicability of using Standard (STD)-101, "Integrated Work Control Process," and a single work plan is highly desired. The following outline procedure is provided to illustrate the proposed process for decanting and treating the V-3 liquid:

- Prepare temporary drum storage area.
- Position liquid decanting, treatment, and containerization skids near Tank V-3 and connect them.
- Inspect apparatus for proper assembly.
- Perform cold system operational (acceptance) (SO) test using water and obtain baseline delta P data across each treatment subsystem unit.

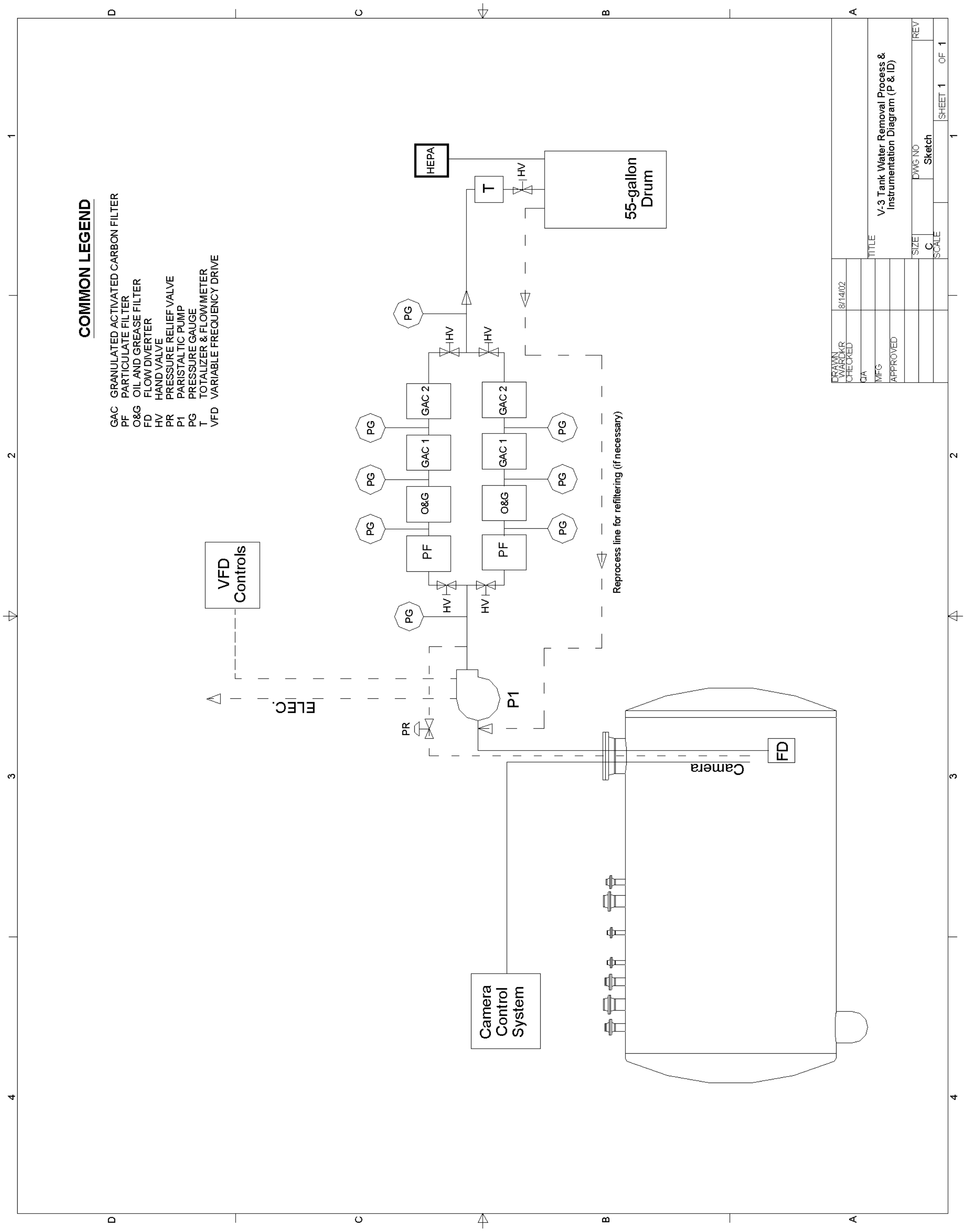


Figure 4. V-Tank Water Removal Process and Instrumentation Diagram.

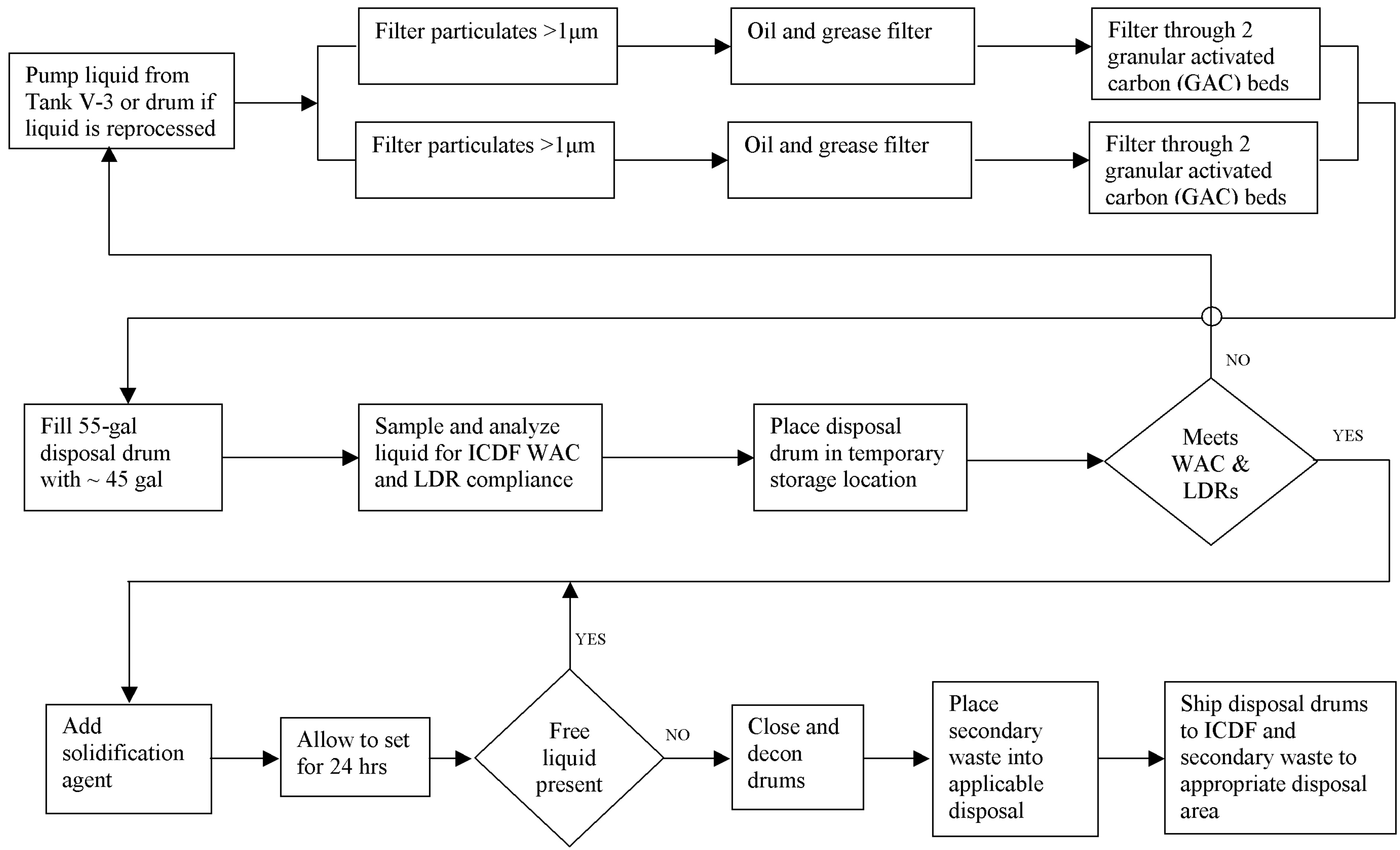


Figure 5. Process flow.

- Radcon will survey for radiation levels.
- Insert video camera/lighting and establish good visibility.
- Insert liquid decant suction hose support assembly into Tank V-3 and adjust height of suction hose in the liquid using the video camera to ensure the sludge is not disturbed.
- Stage the empty drums for filling and attach the treatment subsystem discharge hose to an empty drum fill-lid.
- Decant clear liquid from Tank V-3, initially at a reduced flow rate (e.g. start at 1 to 2 gpm). Visually verify continuously, using the in-tank video, that the sludge is undisturbed and increase flow only if feasible without disturbing the sludge. Stop decanting immediately if the sludge is observed to have been disturbed. Allow any disturbed sludge to settle and make appropriate adjustments in the decant suction subsystem before restarting the decant operation.
- Monitor delta P across each treatment subsystem unit (compare to baseline values recorded during SO testing) for proper operation as the liquid is processed.
- Attach drum fill-lid and fill each 55-gal drum with approximately 45 gal of treated liquid. Verify amount of liquid using flow-meter/totalizer.
- Remove drum fill-lid and place on next drum.
- Sample the liquid in selected drums, according to the approved field sampling plan, to verify contaminant of concern (COC) levels.
- Install drum lid and close using ring clamp.
- If sample results show contaminant levels are too high, move the affected drum to the drum fill skid next to the treatment subsystem and reprocess the liquid until it is acceptable.
- Open the drums containing liquid verified to be acceptable for ICDF disposal (once solidified) in the temporary storage area and add a solidification/stabilization agent.
- Let the solidified/stabilized drums sit for 24 hours to allow the solidifying agent to set, then visually verify no free liquid is present. If free liquid is observed, add more agent, wait for set time, reinspect for free liquid. Repeat as necessary.
- Seal drums verified to have no free liquid. Survey sealed drums for radiological contamination, decontaminate as required, and transport the clean drums to interim storage to await shipment to ICDF.
- When all desired liquid from V-3 has been decanted and treated successfully, disassemble and drain free liquid from all pumping and treatment components back into V-3. The components can then be placed into a 55-gal drum or a 2 × 4 × 8 ft disposal box, depending on the amount of space needed, and then disposed of at the ICDF.
- Dispose of GAC units, and filters that do not meet LDRs, through some thermal process such as Thermal Desorption or shipped off-Site to an independent disposal area such as Envirocare.

5. EQUIPMENT

The following proposed equipment will be used in decanting of the liquid:

- (1) Peristaltic hose-pump, Watson-Marlow/Bredel Model SPX50 equipped with a variable frequency drive (VFD)
- (1) 50 ft of 2-in. Spiralite-115 suction hose with connections (or length as required)
- (2) 50 ft of 2-in. Buna N (nitrile rubber) discharge hose with connections (or length as required)
- (1) 20 ft of 2-in. PVC suction pipe
- (1) Flow diverter
- (1) Positioning clamp for PVC suction pipe
- (3) Particulate filter – a nominal 1 μm, simple cartridge filter (includes 1 spare)
- (3) Oil and grease filter (e.g., BoniFiber, or equivalent, 10 gpm unit – includes 1 spare)
- (5) GAC filter (e.g., Calgon's Flowsorb® prefabricated 55-gal canisters or equivalent – includes 1 spare)
- (3) Concentric fill/filter HEPA filters (includes 2 spares) filters
- (10) Pressure gauges (includes 2 spares)
- (1) Flow meter/totalizer
- (150) 55-gal drums (includes 10 spares)
- Hose/pipe fittings
  - (2) 2 in. 150# Flange fittings (for connecting hoses to pump)
  - (17) 2 in. CAM-LOC fitting (for connecting hoses to filter units and drum fill-lid)
  - (17) 2 in. CAM-LOC nipple (for connecting hoses to filter units and drum fill-lid)
- (5) Ball valves, 2 in.
- (1) Pressure relief valve
- Support tools/equipment.

6. REFERENCES

Blackmore, 1998, Memo from C. S. Blackmore, INEEL, to J. T Taylor, INEEL, Idaho Falls, March 10, 1998, “Criticality Safety Issues Associated with the TAN V-Tanks,” CSB-004-98.

DOE-ID, 1997, *Comprehensive Remedial Investigation/Feasibility Study for the Test Area North Operable Unit 1-10 at the Idaho National Engineering and Environmental Laboratory*, Department of Energy Idaho Operations Office, DOE/ID-10557, Rev. 0, November 1997.

DOE-ID, 2001, *Explanation of Significant Differences for the Record of Decision for the Test Area North Operable Unit 1-10 (Draft)*, Department of Energy Idaho Operations Office, DOE/ID-10908, Rev. C, November 2001.

DOT 49 CFR 173.410, 2001, “Shippers—General Requirements for Shipments and Packagings,” *Code of Federal Regulations,* Office of the Federal Register, October 1, 2001.

EDF-2487, 2002, “V-Tank Estimated Exposure Rate Calculations for Stabilized Liquid Waste from Tank V-3; WAG 1, OU 1-10,” Idaho National Engineering and Environmental Laboratory, Rev. 0, September 2002.

EDF-3067, 2001, “Evaluation of TSF-09 V-Tanks Liquid Level Readings,” Idaho National Engineering and Environmental Laboratory, Rev. 0, December 2001.

EDF-6732, “Design of Tank V-3 Granular Activated Carbon (GAC) System,” Idaho National Engineering and Environmental Laboratory, Rev. Draft, September 2002.

INEL, 1994, *Preliminary Scoping Track 2 Summary Report for the Test Area North Operable Unit 1-05: Radioactive Contamination Sites*, Idaho National Engineering Laboratory, INEL-94/0135, Rev. 0, October 1994.

MCP-3562, 2002, “Hazard Identification, Analysis and Control of Operational Activities,” Rev. 5, *Companywide Manual 9—Operations*, Nuclear Operations and Operational Excellence, October 2002.

Nielson, 2002, Letter from J. W. Nielsen to G. E. McDannel, “Criticality Issues Associated with the Removal and Storage of the Material from the TAN V-Tanks; V-1, V-2, V-3, and V-9,” JWN-02-02, June 17, 2002.

STD-101, 2002, “Integrated Work Control Process,” Rev. 13, *Companywide Manual 6—Maintenance,* Site Maintenance, October 2002.

Wallace, 2002, Letter from B. W. Wallace to G. E. McDannel, “V-Tank V-3 Excess Supernatant Liquid Options,” BWW-19-02, September 24, 2002.